UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

OFFICE OF
AIR AND
RADIATION

Michael Gerle
Director
Environmental Regulatory Compliance
U.S. Department of Energy
P.O. Box 3090
Carlsbad, New Mexico 88221

Dear Mr. Gerle:

As we did with the recertification decision in 2017, we have developed a table (Enclosure 1) that consolidates the technical issues EPA identified during its review of the WIPP CRA-2019 performance assessment (PA). The table outlines EPA's expectations for issue resolution and cross references related issues from CRA-2014 where applicable. We expect the table will change over time to reflect resolution of the items. EPA has also attached to this letter a path forward on the Culebra Dolomite based on discussions during the technical exchange held the week of May 22, 2022 (Enclosure 2). These have been incorporated into EPA's expectations in Enclosure 1.

The issues in Enclosure 1 have been grouped by priority based on their potential effect on releases and their impact on defensibility of PA calculations and the CRA. EPA expects the first priority issues to be addressed and resolved prior to any future PA calculations, including the upcoming Planned Change Request (PCR) for new panels. In particular, EPA expects that any baseline solubility calculations in the PCR will be performed using a revised CRA-2019 actinide geochemical database as well as geochemical modeling assumptions that incorporate the following (items 5-8 and 11 in Enclosure 1):

- EDTA: corrected problems with $CaEDTA^{2-}$, $MgEDTA^{2-}$, and $AmEDTA^{-}$ stability constants and address the lack of derivation and testing of some $EDTA^{4-}$ Pitzer parameters
- Calcite saturation: changed assumption that calcite would precipitate to saturation
- Phase 5: verified phase 5 stability constants
- Lead: removed data and omitted in solubility calculations until appropriate Pitzer parameters and verified data can be included
- Am(III): resolved potential internal inconsistencies with selected Pitzer parameters

DOE's CRA-2019 database errors produced values that were not supported by existing laboratory and field observations. In addition, the listed items above have resulted in an underestimation of calculated Am(III) releases.

Given the number of issues identified in this recertification, EPA also does not believe the current CRA-2019 PA, “as is”, is an appropriate baseline for comparison with future WIPP PAs. If DOE wants to compare future PA calculations with the CRA-2019 results, in addition to resolving the geochemistry items listed above, DOE at minimum needs to update the following: actinide oxidation states (Enclosure 1, item 4), intrinsic colloids (Enclosure 1, items 12 and 13), microbial colloids (Enclosure 1, items 14 and 15), and borehole plugging patterns (Enclosure 1, item 19).

Please feel free to contact Jay Santillan (Santillan.Jay@epa.gov) if you have any questions. We look forward to working with you to resolve the outlined issues.

Sincerely,

Tom Peake Digitally signed by Tom Peake
Date: 2022.06.30 13:22:08 -04'00'

Tom Peake
Director
Center for Waste Management and Regulations

Enclosures (2)

cc: Anderson Ward, DOE/CBFO
Reinhard Knerr, DOE/CBFO
Mark Bollinger, DOE/CBFO
Ed Garza, DOE/CBFO
Justin Marble, DOE/EM
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Enclosure 1

CRA-2019 Issues Table
June 30, 2022

First Priority Issues: Significant issues that impacted the defensibility of the CRA-2019 DPA. DOE should prioritize and resolve these issues before any future PA calculations.
Second Priority Issues: Important issues DOE should prioritize for the PCR and should come to an acceptable resolution before CRA-2024 to increase PA defensibility.
Third Priority Issues: Issues that will increase PA defensibility. Issues may not be completely resolved before the PCR but DOE should have a reasonable path forward to resolve for CRA-2024.

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
FIRST PRIORITY ISSUES							
1	Performance Assessment Baseline	Use of the CRA-2019 as a baseline	FR Notice	Section E	Use of previous CRA PAs or PABCs as the baseline for the next PA	NA	DOE should not use DOE's CRA-2019 assessment as a new baseline for WIPP performance without appropriate adjustments that address EPA's major recertification review comments. These adjustments include updating parameters related to: actinide oxidation states (item 4), geochemical database (items 5-8 and 11), intrinsic colloids (items 12 and 13), microbial colloids (items 14 and 15), and borehole plugging patterns (item 19)

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
2	Gas generation	Alpha radiolysis of adsorbed water under unsaturated conditions	Chemistry	3.6.2	Not included in gas generation calculations	NA	Provide a more thorough analysis of the potential effects on gas generation rates; consider potential effects of deliquescent salts on surfaces on water adsorption and radiolysis
3	Gas generation	CPR radiolysis	Chemistry & FEP	3.6.3 & FEP Table 2	Not included in gas generation calculations	NA	Provide a more thorough analysis of the potential effects on gas generation rates, including the potential effects of higher gas generation rates early in the repository history
4	Actinide solubility	Plutonium, neptunium, and uranium oxidation states	Chemistry	6.3	Most reducing oxidation states [Pu(III), Np(IV), and U(IV)] are assumed in 50% of PA realizations, and more oxidizing [Pu(IV), Np(V), and U(IV)] are assumed in 50% of PA realizations	Per the September 2018 Technical Exchange, DOE will not change the oxidation state ratio in CRA-2019 PA. EPA path forward for 2019 may include outside technical review or a sensitivity study.	Most reducing oxidation states [Pu(III), Np(IV), and U(IV)] will be assumed in all PA realizations unless DOE provides an acceptable alternative; DOE should still needs to conduct research and update the expected WIPP chemical conditions understanding
5	Actinide solubility	DATA0.FM4 EDTA data revisions	Chemistry	7.4.3, 7.4.5, and Attachment B Section B.4.1	DATA0.FM4 data results in significant underestimation of dissolved Am(III) concentrations	Resolved. Per September 2018 Technical Exchange, documentation will be provided in Appendix GEOCHEM	Revise database and demonstrate that available experimental data can be adequately modeled
6	Actinide solubility	Calcite saturation assumption	Chemistry	7.4.6	Calcite assumed to precipitate to saturation, resulting in large amounts of Phase 5 precipitation and water consumption	NA	Assume slight oversaturation with respect to calcite, consistent with the presence of known calcite precipitation inhibitors in WIPP brines

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
7	Actinide solubility	DATA0.FM4 Phase 5 solubility data verification	Chemistry	7.4.6, 12.4.2, and Attachment B Section B.3.2	Solubility constant for Phase 5 in DATA0.FM4 has not been verified	NA	Verify Phase 5 solubility by comparing calculated solubilities with experimental data
8	Actinide solubility	DATA0.FM4 lead data	Chemistry	7.4.7 and Attachment B	DATA0.FM4 data are inadequate because of missing Pitzer parameters, no systematic evaluation of lead solid phases that may form in WIPP environment, and no demonstration that the data can be used to simulate high ionic strength experimental data	Resolved. Per September 2018 Technical Exchange, documentation will be provided in Appendix GEOCHEM	Remove lead data from database and omit from solubility calculations until a complete data set and evaluation is performed
9	Actinide solubility uncertainty distribution	Literature search cutoff date	Chemistry	7.4.11	DOE used a publication cutoff date of October 31, 2011	Resolved. Per email to R. Patterson on October 23, 2018, DOE agrees to use the criteria from the SEN4 study, with the exception of the Khalili et al. (1994) data which EPA has previously agreed should be omitted.	For all future CRAs, the cutoff date for publications used to develop the +III and +IV actinide solubility uncertainty distributions must be updated to the latest date that can be implemented
10	Actinide solubility uncertainty distribution	Effects of the relative amounts of available data on actinide solubility uncertainty distributions	Chemistry	7.4.11	DOE includes all solubility data reported by selected publications, although the availability of more actinide solubility data for some conditions (e.g., less-crystalline solid phases) may bias the	Resolved. Per email to R. Patterson on October 23, 2018, DOE agrees to use the criteria from the SEN4 study, with the exception of the Khalili et al. (1994) data which EPA has previously agreed should be omitted.	Investigate alternative approaches available to address the actinide solubility uncertainty distribution

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
					resulting actinide uncertainty distributions		
11	Actinide solubility	Am(III) data in DATA0.FM4	Chemistry	Attachment B Section B.7.2	Am(III) Pitzer parameters were obtained from Könnecke et al. (1997), Oakes et al. (2021) identified potential internal inconsistencies	Resolved. Per telecon on 06/27/18, updates will be revisited for CRA-2024.	Evaluate possible internal inconsistencies in the WIPP Am(III) model
12	Colloids	Am(III) intrinsic colloid concentration	Chemistry	8.1.4	Intrinsic colloid parameter for Am(III) (AM:CONCINT) is less than most of the concentrations calculated from sequential filtration data for Nd(III)	Resolved. DOE will use bounding values and increase the pcH range to 8.5-10.5 in the CRA-2019 PA.	Increase the AM:CONCINT concentration to adequately bound the Nd(III) experimental data
13	Colloids	Th(IV) intrinsic colloid concentration	Chemistry	8.1.5	Intrinsic colloid parameter for thorium (TH:CONCINT) is not consistent with available data	Resolved. DOE will use bounding values and increase the pcH range to 8.5-10.5 in the CRA-2019 PA. DOE (LANL) stated during the 06/27/18 teleconference that they are collecting data and will have something to present in October.	Increase TH:CONCINT concentration to be consistent with the Th(IV) experimental data

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
14	Colloids	Maximum microbial colloid parameters	Chemistry	8.3.5	DOE has not adequately justified CRA-2019 DPA CAPMIC values	Per the September 2018 Technical Exchange and October 2018 Telecon, a path forward was identified for the microbial colloids. EPA submitted questions to DOE. Acceptance of updated approach was contingent on DOE's responses to the questions, which were provided as part of the CRA-2019 documentation.	CAPMIC values must be consistent with available data, use values calculated by EPA from Papenguth (1996, Table 2) until DOE provides more experimental data to adequately justify an update
15	Colloids	Microbial colloid proportionality constants	Chemistry	8.3.5	DOE has not adequately justified CRA-2019 DPA PROPMIC values	Per the September 2018 Technical Exchange and October 2018 Telecon, a path forward was identified for the microbial colloids. EPA submitted questions to DOE. Acceptance of updated approach was contingent on DOE's responses to the questions, which were provided as part of the CRA-2019 documentation.	PROPMIC values must be consistent with available data, use CCA values until DOE provides more experimental data to adequately justify an update
16	Surplus Pu Waste Loading	Surplus plutonium waste	Chemistry	11.0	PA calculations may not account for the potential loading of waste stream SR-KAC-PuOx into a single panel; SR-KAC-PuOX represents about 30% of the decay heat, but only 3% of the waste	NA	Evaluate the potential effects of radiolytic gas generation on PA when the SR-KAC-PuOX waste stream is placed in a limited number of panels

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
					volume in the current inventory		
17	Inventory data	Inclusion of ATWIR (2017) data in CRA-2019 Section 24 that were not used in CRA-2019 DPA	Inventory	1.1 and 3.5.1	The inventory used to prepare data presented in CRA-2019 Section 24 (ATWIR 2017) was based on an inventory cutoff date of December 31, 2016, but an inventory with a later cutoff date of December 31, 2017 (ATWIR 2018) was used for the CRA-2019 DPA calculations. Multiple other CRA sections had similar issues	NA	For future CRAs, DOE must include the same data in Section 24 of the CRA as is used in the accompanying PA. Likewise for other CRA sections
18	Waste characteristics	Requirement [40 CFR 194.24(b)] for DOE to identify and assess all waste characteristics for their impact on disposal system performance, and to submit	Inventory	3.5.2	Tables that describe the inclusion or exclusion of waste characteristics and components have not been updated since the CRA-2004, and contain entries that are inconsistent with the CRA-2019 DPA	NA	Provide an updated listing of all waste characteristics and components that are included or excluded from consideration along with substantiating analyses in all future CRAs

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
		an analysis substantiating decisions to exclude consideration of a waste characteristic or component					
19	Borehole plugging pattern	Frequency calculation methodology	Borehole & FEP	Borehole 3 FEP H31 H32	KPLA-based calculation used in CRA-2019 was not accepted by EPA	NA	Use previously approved, original methodology or propose an acceptable alternative
20	Drilling rate	Deep drilling rate calculation methodology	Borehole	2	Current approach underestimates/creates additional lag in deep drilling rates and repository releases The current approach may also overcount deep boreholes (if only vertical boreholes are counted or multiple horizontal deviations from the same vertical borehole are counted). Depending on what the review shows, it could change the drilling rate	NA	Update the current methodology to better address lag in the deep drilling rate calculation; provide a clearer discussion and documentation of the limitations and data availability

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
21	Salado Flow model	Repository redesign	APCS	4	The BRAGFLO Salado Flow model used in the CRA-2019 PA does not adequately simulate the planned repository redesign	NA	Continue developing a replacement for the current model that adequately simulates the planned repository redesign
22	Salado Flow model	Creep closure of open rooms	APCS	4	The current BRAGFLO Salado Flow model treats empty rooms as retaining high porosity and permeability for the duration of the 10,000-year regulatory period	NA	Utilize new rock mechanics analyses to improve the state of knowledge and inform the process model. Continue developing a methodology for simulating creep closure of rooms with and without roof falls into the Salado Flow Model to replace the APCS approach for CRA-2024.
23	Delaware Basin Drilling Surveillance Program (Monitoring)	Database anomalies	Boreholes	Appendix B	A number of potential database errors made apparent when data in the Delaware Basin Monitoring Annual Report was compared from year to year	NA	WIPP boreholes database should be reviewed, missing boreholes investigated, and resolved; corrections and explanations provided in future reports
SECOND PRIORITY ISSUES							
24	Salado mineralogy	Likely overestimation of polyhalite percentage in Salado Formation	Chemistry	2.2 and 7.4.8	DOE currently estimates that polyhalite comprises 1.7 to 2.5 wt% of the Salado Formation, which is an apparent overestimation based on data in Stein (1985). Including polyhalite in actinide	NA	Re-evaluate available Salado mineralogy data to determine a reasonable percentage of polyhalite in the Salado Formation and its impact to solubility

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
					solubility modeling calculations could cause excess Phase 5 precipitation and brine consumption.		
25	Actinide solubility	Inclusion of silica aqueous species and solids in the actinide solubility modeling calculations	Chemistry	2.3 and 8.1.6	DOE currently omits silica from the actinide solubility modeling calculations. However, dissolved silica will be present in WIPP brines. Th(IV) has been shown to form complexes with silica at high pH, which may increase modeled +IV actinide solubilities	NA	Evaluate the available high-ionic-strength silica data for inclusion in the WIPP thermodynamic database and actinide solubility calculations
26	Gas generation	Steel surface area	Chemistry	3.1.4	Current PA value is 11.2 m^2/m^3 for steel surface area per cubic meter of volume in a room	Resolved. Comment from November 2017 technical exchange—makes sense to revisit periodically; if no change in containers, no need to change; no change needed for CRA-2019	Calculate steel surface area per unit disposal volume using updated inventory data, sheet metal surrogate and 55-gallon drum surrogate assumptions, and updated waste emplacement data
27	Water balance	MgO hydration rates	Chemistry	4.2.2 and 12.4.1	Premier MgO hydration rates are used, which likely underestimates brine consumption	Resolved. For CRA-2019 by continuing to use CRA-2014 MgO hydration rates. This issue will be revisited in CRA-	Conduct hydration rate experiments with Martin Marietta MgO

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
						2024 after experiments are completed.	
28	Actinide solubility	Calculations of initial solid phase quantities	Chemistry	7.8.4	Minimum brine volume used to calculate moles of initial solids in all actinide solubility calculations, but the moles of initial solids should decrease with increasing brine volumes	NA	Recalculate the initial moles of solids to be consistent with the brine volume
29	Actinide solubility	DATA0.FM4 citrate data revisions	Chemistry	7.4.5 and Attachment B Section B.4.2	DATA0.FM4 aqueous speciation and stability constants are not completely consistent with Hummel et al. (2005) and Choppin et al. (2001), and earlandite solubility was omitted	Resolved. Per September 2018 Technical Exchange, documentation will be provided in Appendix GEOCHEM	Revise database to be consistent with available data, include earlandite solubility
30	Actinide solubility	DATA0.FM4 oxalate data revisions	Chemistry	7.4.5 and Attachment B Section B.4.3	DATA0.FM4 aqueous speciation and stability constants are not completely consistent with Hummel et al. (2005)	NA	Revise database to be consistent with available data
31	Actinide solubility	DATA0.FM4 acetate data	Chemistry	7.4.5 and Attachment B Section B.4.4	DATA0.FM4 acetate speciation has not been revised since PABC-2004	NA	Assess whether additional Am(III)-acetate and Th(IV)-acetate species should be added to the database
32	Actinide solubility	DATA0.FM4 iron data	Chemistry	7.4.7 and Attachment B Section B.5.0	Iron data in DATA0.FM4 are incomplete because of missing Fe(II)-sulfate	Resolved. Per September 2018 Technical Exchange, documentation will be provided in Appendix	Add Fe(II)-sulfate Pitzer parameters and solid phases to the WIPP thermodynamic database

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
					Pitzer parameters and Fe(II)-sulfate solids	GEOCHEM	
33	Actinide solubility	Effects of sulfide and phosphate on iron and lead solubilities and speciation with organic ligands	Chemistry	7.4.7 and Attachment B	Iron and lead interactions with organic ligands are not included in DATA0.FM4 or actinide solubility calculations	NA	Iron and lead interactions with organic ligands should not be included in actinide solubility calculations without also including the effects of sulfide and phosphate
34	Actinide solubility uncertainty distribution	Defensibility of approach	Chemistry	7.4.11	The actinide solubility uncertainty distribution is calculated by comparing modeled solubilities to experimentally determined solubilities	Resolved. Per email to R. Patterson on October 23, 2018, DOE agrees to use the criteria from the SEN4 study, with the exception of the Khalili et al. (1994) data which EPA has previously agreed should be omitted.	Defensibility of the actinide solubility uncertainty approach would benefit from an evaluation of alternative approaches
35	Actinide solubility	Effects of borate on +III actinide solubilities	Chemistry	Attachment B Section B.7.5	Am(III)-borate aqueous speciation and solid phases are not included in the WIPP thermodynamic database	Resolved. Per telecon on 06/27/18, updates will be revisited for CRA-2024.	Evaluate available data and include these species and solid phases if sufficient data are available
36	Actinide solubility	Th(IV)-carbonate speciation and log β^0 values	Chemistry	Attachment B Section B.8.2	DATA0.FM4 Th(IV)-carbonate data appear to underpredict aqueous speciation	Resolved. Per telecon on 06/27/18, updates will be revisited for CRA-2024.	Update to be consistent with Altmaier et al. (2006) data
37	Colloids	Formation of actinide pseudocolloids from MgO reaction products	Chemistry	8.1.2	MgO pseudocolloid effects excluded based on Cs^+ sorption study	NA	Sorption data obtained with +III and +IV analogues needed to resolve uncertainties

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
38	Colloids	Silica colloids	Chemistry	8.1.6	Silica mineral fragment colloids are not considered	NA	Evaluate the potential effects of the formation of structural silica colloids with +IV actinide species
39	Colloids	Humic colloid proportionality constants	Chemistry	8.2.2	Humic colloid parameters calculated from experiments with EDTA, but DATA0.FM4 EDTA data issues may have small effects on these parameters	NA	Evaluate the effects of EQ3/6 database EDTA data on humic colloids proportionality constants
40	Colloids	Organisms likely to be present in the repository	Chemistry	8.3.5	Swanson et al. (2021) performed a rough calculation estimating the number of Bacillus spores that could be introduced through waste	Per the September 2018 Technical Exchange and October 2018 Telecon, a path forward was identified for the microbial colloids. EPA submitted questions to DOE. Acceptance of updated approach was contingent on DOE's responses to the questions, which were provided as part of the CRA-2019 documentation.	Extend calculations to other representative organisms, including bacteria and fungi in the waste, and archaea in brine to provide a clearer picture of which organisms will likely dominate the 1.0E+09 cells/ml biomass in the post-repository environment
41	Water balance	Effects of Phase 5 formation	Chemistry	12.0	Phase 5 formation is not included in water balance	NA	Assess the possible effects of significant Phase 5 formation on the water balance calculations by re-evaluating its solubility and investigating its formation in Martin Marietta MgO hydration experiments

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
42	Emplaced CH and RH waste volumes	CH and RH waste volume breakdown by waste generator site	Inventory	3.1.2 and 3.1.3	Total unscaled emplaced and temporary storage volumes are provided, but information is not provided by waste generator site	NA	Provide emplaced and temporary storage volumes by waste generator site for CRA-2024
43	Culebra flow and transport	Repository-induced subsidence	FEP	FEP W23	The DOE argument that the effect on the Culebra of subsidence due to repository excavations is intrinsically incorporated in the base-case field transmissivities is not adequately supported.	NA	Provide an updated evaluation of subsidence due to the expanded repository footprint and its effect on Culebra hydrology
44	Culebra flow and transport	Microbe-facilitated transport	FEP	FEP N71	The DOE argument that microbe-facilitated radionuclide transport to the LWB will not occur in the Culebra due to physical filtration is not adequately supported.	NA	Provide an updated evaluation of microbe-facilitated radionuclide transport in the Culebra and the potential effects of filtration.
45	Culebra flow and transport	Impact of groundwater extraction	Culebra & FEP	Culebra TSD, FEP H26	DOE analysis of Mills well pumping has shown that the impact of groundwater extraction is not adequately simulated in the Culebra flow and transport models	NA	Follow up discussion; see Enclosure 2

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
46	Culebra flow and transport	Transport modeling	Culebra	Culebra TSD	The current Culebra transport model has not been approved in peer review	NA	Follow up discussion; see Enclosure 2
THIRD PRIORITY ISSUES							
47	Gas generation	Gas production stoichiometry	Chemistry	3.1.1	Formation of magnetite or green rust is assumed not to occur	NA	Continue to evaluate available data to determine if gas production stoichiometry should be re-evaluated
48	Gas generation	Lead corrosion	Chemistry & FEP	3.2.1	Assumed not to contribute significantly to gas generation	Resolved. Per the September 2018 Technical Exchange, DOE will estimate bounding surface areas for lead for future CRA PAs. If surface areas become significant relative to steel surface areas, lead corrosion rates will be taken into account in PA.	Re-evaluate lead corrosion contributions to gas generation if lead inventory increases significantly
49	Gas generation	Galvanic coupling	Chemistry & FEP	Chemistry 3.3; FEP 2.2 and FEP Appendix A CC5-SCR-8	Assumed not to contribute significantly to gas generation	NA	No evidence that galvanic corrosion should be screened into WIPP PA but screening argument should be updated
50	Actinide solubility	Effects of cement on actinide solubility calculations	Chemistry	7.4.9	Cement inventory not included in initial solids	NA	Re-assess potential effects of cements on actinide solubility calculations if cement inventory increases significantly

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
51	Heterogeneous waste loading	Shielded containers	Chemistry	11.0	PA calculations do not address effects of increased steel and lead in shielded containers, which will mostly be placed in future WIPP panels	NA	Increased masses of steel and lead in shielded containers could affect gas generation rates, but lower lead and steel surface areas and slower lead corrosion rate mitigate these possible effects. DOE should assess the impacts of the added steel and lead that will be placed in future WIPP panels.
52	Natural FEPs	Regional geology	FEP	Table 3	Numerous FEP screening arguments for Delaware Basin geology need to be updated with recent information	NA	DOE should update screening argument descriptions of regional geology for the CRA-2024
53	Natural FEPs	Karst	FEP	Table 3	Numerous FEP screening arguments for the occurrence of karst in the northern Delaware Basin need to be updated with recent information	NA	DOE should update screening argument discussions of karst for the CRA-2024
54	Oil and gas exploration	Drilling practices	FEP	Table 2	FEP H1 description of oil and gas drilling practices in the Delaware Basin need to be updated with recent information	NA	DOE should update screening arguments of drilling practices for the CRA-2024 to reflect the significant changes since the CCA
55	Groundwater extraction	Groundwater exploitation	FEP	Table 2	FEPs H5 and H26 address similar subjects and the differences need to be clarified	NA	DOE should clarify the differences between "extraction" and "exploitation" for the CRA-2024

Number	Topic	Subtopic	TSD	Section(s)	Current Approach	2017 Recertification Resolution	2022 Recertification EPA Expectations
56	Shaft seal cement	Actinide solubility	FEP	Table 2	FEP W8 Shaft seal chemical composition screened as "beneficial" Also see W56.	NA	FEP screening supported a conclusion of "low consequence" rather than "beneficial" and should be reworded accordingly.
57	Movement of containers	Roof falls	FEP	Table 2	FEP W33 does not address container movement due to roof falls	NA	The screening argument should address movement of containers from roof falls.

Enclosure 2

Culebra Path Forward for Resolution of Issues

Based on DOE's responses to EPA's CRA-2019 Completeness Comments as well as information DOE presented at the Culebra Technical Exchange held in April 2022 it appears to EPA that there is a significant amount of information supporting the Culebra conceptualization that should be integrated into a comprehensive document addressing questions and aspects of the Culebra conceptual model for groundwater flow and radionuclide. For example:

- What are the causes of the large water-level fluctuations in the Culebra and would changes in gradient, degree of confinement, etc., affect the current conceptualization that assumes steady-state conditions?
- Is the assumption of no-recharge, with the exception of the small amount in the southeast portion of Nash Draw, still supported by the water-level and other available data?
- What impact will the incorporation of any revisions to the understanding of the hydrogeology west of the repository and elsewhere have on the Culebra conceptual model?
- Can more recent information assist in refining the transport conceptual model? (Note: the last comprehensive presentation of the conceptual model for transport was provided in Holt (1997).)

In addition to these questions, DOE needs to consider how the PA should be updated to reflect any changes and their potential impact on results should be evaluated. For example:

- Are the assumption of steady-state boundary conditions in the groundwater modeling still valid?
- What is the potential impact of oil/gas production and pumping of permitted/unpermitted groundwater wells on the Culebra groundwater flow and transport?
- Can the recovery rate of the monitoring well(s) nearby the Mills Ranch well be used to estimate the pumping rate when the storativity, transmissivity and well pumping rate are not known?
- What potential impacts could the current uncertainties have on PA (e.g., reasons for large fluctuations in water levels, potential impact of future pumping particularly in the vicinity of Nash Draw)?
- Flow and transport appear to be concentrated within the base of the Culebra (Meigs, Beauheim, Jones, 2000; SAND97-3109) while the model assumes that groundwater flow and transport is equal across the entire aquifer thickness. What impact does this model assumption have on contaminant transport?
- Any work designed to further to refine the conceptualization and/or parameters for PA should also be presented. For example:
    - Can the water-level responses (i.e., drawdown) observed due to the pumping at Mills Ranch be adequately simulated by assigning zones of diffusivity as was done previously for model calibration (as opposed to discrete fractures or fracture zones)?

- Can the recovery rate of the monitoring well(s) nearby the Mills Ranch well be used to estimate the pumping rate when the storativity, transmissivity and well pumping rate are not known?

In summary, DOE needs to document their current conceptualization of groundwater flow and radionuclide transport through Culebra in an integrated manner, including:

- Synthesizing information collected since Holt (1997) into the conceptual model, particularly with respect to radionuclide transport;
- Demonstrate that DOE's current understanding is consistent with empirical data (e.g., changes in water levels, pumping responses due to Mills Ranch well etc.);
- Justify any conceptual model simplifications made for the performance assessment;
- Identify uncertainties in the Culebra transport conceptualization;
- Ascertain potential data gaps (e.g., hydrogeology west of the repository), and
- Provide a description of future activities relevant to continued refinement of the Conceptual Model.

A well-documented synthesis of currently available information will assist EPA and other parties in assessing the basis for DOE's current Conceptual Model, evaluating the defensibility of DOE's assumptions, and understanding DOE's anticipated path forward.